

A combination of photoinitiators and a photosynergist have been found to be most beneficial for photoinduced polymerization and free radical generation. Since acrylates are appreciably oxygen inhibited a combination of approximately 1 percent by coating weight benzophenone and 1.5 percent of a tertiary amine such as triethanol amine have shown to give good surface cure when the coating is ultraviolet radiation cured in an air (oxygen containing) environment. For through cure a 1 percent by weight addition of diethoxy-acetophenone has shown fast cure characteristics. The types of photosynergists to be utilized include compounds containing easily abstracted hydrogen. Particularly reactive H-donors are those in which the active H-atom is positioned alpha to an oxygen, as in alcohols and ethers, to a nitrogen, as in tertiary amines, or to sulfur as in thiols. Among the most commonly used photosynergists dimethylethanol amine, methyldietanol amine and triethanol amine have been found to be the most reactive.

Other trace additives have been found to enhance the properties of the cured coating. The addition of anti-static agents has been found beneficial when plastic films are coated. There are a number of compounds suitable for anti-static agents. I have found the best to be quarternary ammonium compounds, e.g., stearamidopropyl dimethyl-hydroxyethylammonium benzoate, tetraethylammonium acetate, (3-lauramidopropyl) trimethylammonium methylsulfate (Cyastat LS, Cyanamid). I have found a 1 percent addition of an olefinic quarternary ammonium compound, e.g., (3-lauramidopropyl) trimethylammonium methyl sulfate trade named Cyastat LS by American Cyanamid, to be particularly satisfactory for this purpose.

The tertiary amine photosynergists mentioned previously oxidize to form colored by products with ultraviolet radiation (U.V. hereafter) exposure. I have found a 0.5 percent addition of a hindered amine light stabilizer such as Bis (2,2,6,6-tetramethylpiperidiny-4) Sebacate trade named Tinivun 770 by Ciba-Geigy to greatly enhance the non-yellowing properties of the novel coating composition. Apparently this material reacts to chemically subtract yellowing from a resin which has yellowed. Most other compounds prevent yellowing by working as ultraviolet radiation absorbers, effectively limiting the degree of ultraviolet exposure seen by the host resin. These latter compounds are less preferable for ultraviolet curable coatings since ultraviolet exposure is a necessity for resin cure.

This composition is preferably made by dissolving first the benzophenone into the melamine acrylate at about 50° C. The silicas are then dispersed into the mixture at moderate shear not to exceed 70° C. Next the antistatic agent, light stabilizer and diethoxyacetophenone are dispersed into the mixture at moderate shear. Once a uniform mixture is obtained, the tertiary amine photosynergist is incorporated at low shear holding the mixture temperature below 50° C. The finished coating is then allowed to cool and wet out prior to application.

I have found that the physical properties of the cured resin are excellent in the 10 micron thickness range, the thickness of approximately two to three lithographic printings. Under proper conditions of cure, my coating has shown Taber losses of 8-10 mg when tested with a CS-17 wheel, 1000 g load for 1000 cycles which is very abrasion resistant and is roughly four times more abrasion resistant than the standard Polane two-part urethane coating of much greater thickness.

The chemical resistance to solvents of this cured coating has also been found to be excellent. A thirty minute solvent saturated cotton swab exposure to such solvents as pyridine, methylethyl ketone, methylene chloride, tetrahydrofuran, isopropanol, dimethylformamide, acetonitrile, dioxane, ethylacetate, point 1 normal Hydrochloric acid, carbon disulfide, ether, 6% caustic etch, chloroform and benzene have shown little or no effect on the coating.

The lithographic printing qualities of my coatings are also excellent. The coating does not appear to appreciably emulsify with the water based etch solution used for printing. The coating spreads uniformly on the printing rollers and deposits uniformly on the substrate being coated. The coating can be printed in an analogous manner to conventional printing inks giving very high resolution printed detail. These litho properties are particularly advantageous in allowing the ability to selectively print areas of different gloss values on the substrate. For example, when the coating is used to protect an instrument front panel a high gloss coating containing six percent silica and producing 60% gloss can be printed over display window areas, and a low gloss coating containing eight percent silica and producing 35% gloss can be printed over the rest of the instrument front panel. In this manner, the diffusion effect of the matte surface is minimized in areas needing to transmit optical information (e.g. L.E.D. displays) while the rest of the front panel still maintains a desired gloss reading.

The current coating formulation cures at roughly 120 feet per minute belt speed when the printed sheet is passed under three Hanovia type reflectors with 200 watt per inch mercury vapor lamps. The high speed and lack of substantial absorbed heat allowed by the U.V. cure process provide a process particularly useful for thermally sensitive substrates such as plastic film. When several coatings are needed, the U.V. process allows the ability to immediately recoat without loss in registration due to the expansion, contraction or permanent shrinkage induced by conventional heat processes.

Additionally, the coating is flexible and moderately formable. I have subjected a coated piece of 0.015 inch polycarbonate to approximately 0.015 inch radius bends without cracking or otherwise reducing the cured properties of the coating.

I claim:

1. A composition of matter for application as a barrier coating, said composition consisting essentially of: trimethoxymethyl tri-2-ethoxy acrylate methyl melamine; silica; and a photoinitiator.
2. A composition as in claim 1 wherein trimethoxymethyl tri-2-ethoxy acrylate methyl melamine comprises greater than 50% by weight of the composition.
3. A composition as in claim 1 comprising an antistatic agent.
4. A composition as in claim 1 comprising a hindered amine stabilizer.
5. A composition as in claim 3 wherein the antistatic agent is (3-lauramidopropyl) trimethyl ammonium methyl sulfate.
6. A composition as in claim 4 wherein the hindered amine stabilizer comprises Bis (2,2,6,6-tetramethylpiperidiny-4) Sebacate.